2017

The Opioid Epidemic in the United States with a Focus on Ohio

Timothy A. Netters Jr.
Wright State University - Main Campus

The Opioid Epidemic in the United States with a Focus on Ohio

Timothy A. Netters, Jr.

Wright State University Boonshoft School of Medicine

Master of Public Health Program

Nikki L. Rogers, PhD, CPH – Committee Chair

Sara Paton, PhD, CPH – Committee Member

Table of Contents

Abstract

The rate of deaths due to opioid drug overdoses has increased substantially in the 21st-century United States and shows no signs of slowing down**.** Ohio received the dubious distinction of having the most opioid-related deaths in 2015. Montgomery, Cuyahoga, and Hamilton counties are currently on pace to top their totals from 2016. This literature review sought to define opiates and opioids, explore what makes these substances so addictive and deadly, detail the policies and practices that contributed to the current epidemic, detail the current problem in Ohio and the counties that have seen the greatest increase in the number of deaths, and discuss the available interventions and community programs trying to slow the pace of the deaths. The opioid epidemic has had numerous contributors, including the introduction as pain as the fifth vital sign, the reformulation of commonly abused prescription drugs and the establishment of pill mills. The relative ease with which opioids are able to enter the United States from other countries and the proliferation of foreign and domestic clandestine labs has helped to push the opioid use and abuse. The primary intervention is Opioid Overdose Education and Naloxone Distribution (OEND) programs and making naloxone readily available in those communities hit hardest. However, with more powerful synthetic opiates in conjunction with combining several opiates into one product, it is taking more naloxone to reverse suspected overdoses. The versatility and multidisciplinary skills of the public health workforce will play an integral role in helping to address this multifaceted problem.

Keywords: heroin, fentanyl, carfentanil, naloxone, Opioid Overdose Education and Naloxone Distribution (OEND) programs, overdose

The Opioid Epidemic in the United States with a focus on Ohio

The rate of deaths due to opioid drug overdoses has increased substantially in the 21st-century United States and shows no signs of slowing down**.** Goleman (1987) stated that opioid drugs are not inherently dangerous when used for their specified purpose of relief of moderate to severe acute pain. However, when they are abused, mixed with other drugs, or their stronger counterparts, used for chronic pain or are used without understanding of their increased strength the effects can be devastating. Ohio is unfortunately no stranger to the problem of opiate abuse and overdose. Counties throughout Ohio have had to add additional space to local morgues to accommodate the ever-growing number of overdose deaths, to the point of having to utilize mobile cooling units to store the bodies of opioid overdose victims (Llorente, 2017). The state of Ohio received the dubious distinction of having the most opioid-related deaths in 2015 (Llorente, 2017). Montgomery, Cuyahoga, and Hamilton counties are currently on pace to top their totals from 2016 due to the introduction of even more powerful synthetic opiates(detailed in subsequent sections). This literature review sought to define opiates and opioids, explore what makes these substances so addictive and deadly, detail the policies and practices that contributed to the current epidemic, detail the current problem in Ohio and the counties that have seen the greatest increase in the number of deaths, and discuss the available interventions and community programs trying to slow the pace of the deaths. It is hoped that this review is clear and beneficial in underscoring the scope of the epidemic and provides insight into why system-wide interventions are needed to address this public health emergency.

What is an Opiate?

The National Institute on Drug Abuse (2014a) states that opiates are powerful natural pain relievers derived from morphine that are used primarily for acute non-cancer pain and (since

the 1990s) chronic pain. Morphine appears naturally in the seed pod of the Asian opium poppy plant and acts on Mu receptors in the brain. Mu receptors are located in the brain's 'reward center' (pleasure chemical pathways) and release dopamine when activated. Dopamine contributes to the 'opiate high' (pleasurable feeling of wellness and comfort) and the decreased perception of pain associated with its use. Opiates also induce a marked decrease in breathing rate, mental function, and heart rate (National Institute on Drug Abuse, 2014b). The long-term use of opiates can lead to *tolerance*, which is defined as requiring more of the medication to elicit the same pain-relieving effects. Developing tolerance to this class of medications has the potential to lead to addiction and overdose due to the body not responding as strongly to the same dose of the drug (Allouche, Noble, & Marie, 2014).

What are Opioids?

Drugs have been manufactured that mimic the effects of opiates. *Opioid* (opiate-like) painkillers are comprised of two categories: 1) opiates (as described above) that are direct extracts from the natural opium poppy, and 2) extracts of the poppy plant that have been infused with other chemicals *or* substances that are completely manmade compounds that mimic the effects of opiates; the second category is also called synthetic opioids (The National Safety Council, 2014). Opioids have a similar chemical structure to opiates but are orders of magnitude stronger than the opiates on which they are based. The strength of an opioid depends on two factors: 1) the ease of which it crosses the blood brain barrier, and 2) how strongly it binds to the receptor(s) in the brain. Because opioids are manufactured synthetic products, unethical manufacturers can introduce substances that should not be ingested by humans.

Synthetic Opioids

Heroin

Various types of natural opioids exist. Heroin, codeine, and morphine are natural derivatives of opium (The National Safety Council, 2014). It is readily available in the illicit drug trade due to a massive influx from Mexico that contributes to its relatively cheap price (Pflaum, 2016). The pharmacokinetic properties of the drug itself attests to the drug's popularity. Upon human inhalation or injection, heroin is converted to morphine. The chemical makeup of morphine and heroin are slightly different. This difference allows heroin to cross the blood brain barrier more quickly, making it approximately three times the strength of pure morphine. The user risk increases when individuals that use heroin daily or in large doses begin to develop a tolerance, thus, require more of the drug to achieve the same 'high'. However, the more heroin used, the more dramatic the effects on breathing, heart rate, and mental function. Respiratory depression is often the cause of death during opioid overdoses (White & Irvine, 1999). In addition to using more heroin to achieve their high, users may combine/dilute or 'cut' pure heroin (the original manufactured product) with other drugs (e.g., cocaine, marijuana, LSD) to illicit a stronger high (American Addiction Centers, n.d.). Not only can heroin be diluted to distribution-level strength with other drugs, unethical sellers can also cut their products with caustic chemicals such as rat poison, laundry detergent, or other substances (American Addiction Centers, n.d.) that are not meant for human ingestion and exponentially increase the risk associated with using heroin.

Fentanyl

Fentanyl, like heroin, acts on the same brain receptors as morphine. The difference is that fentanyl binds even more strongly to the mu receptor, prolonging its potentially deadly effects

(National Institute on Drug Abuse, 2016). Fentanyl's chemical composition can be, and often is, altered to create *methylfentanyl*. Methylfentanyl is the form of the drug that is commonly abused on the streets (Higashikawa & Suzuki, 2008) (however, this manuscript follows local law enforcement usage, calling all variants of this drug fentanyl). Due to its altered composition, fentanyl can be anywhere from 50 to 100 times more potent than heroin (Stewart, 2014). In essence, users need a significantly lower amount of this drug to cause the respiratory failure that is often the cause of overdose deaths (see Figure 1). Because fentanyl can be made in a home lab and relatively cheaply, it is often used to dilute the heroin that is made for street distribution to extend the supply of the dealers. The issue with heroin being cut by its stronger counterpart is that the people who buy and use the final product have no real idea of the drug's composition. Without knowing exactly what they are buying from they're dealer, users are often getting fentanyl instead of heroin or a mixture that has very little actual heroin. Such users think they're using their expected amount of heroin when they take their usual dose of the product, when in actuality they're taking a lethal dose of fentanyl (Stewart, 2014). Fentanyl is a dangerous and illicit substance that has played a significant role in perpetuating the current overdose epidemic.

Figure 1. This photo from the New Hampshire State Police Forensic Lab shows a comparison of lethal dose of heroin versus fentanyl. Fentanyl is significantly more potent than heroin (Bond, 2016, top of page).

Carfentanil

Carfentanil, like fentanyl, is a synthetic opioid that acts on the same brain receptors as heroin and morphine. The caveat is that carfentanil is significantly stronger that fentanyl, approximately 100 times stronger and nearly 10,000 times stronger than morphine (National Center for Biotechnology Information, n.d.). The increased affinity that carfentanil has for the mu receptors means that it is even more difficult to reverse by using naloxone. The original marketed use of carfentanil was as a tranquilizer for elephants and other large mammals. It takes as little as 13mg of carfentanil to incapacitate a large animal. To put this into perspective, as little as 1mg– an amount about the size of a grain of salt− of carfentanil to cause enough respiratory depression to kill a human (Recovery First, 2017). This is an incredibly small margin of error: when carfentanil is used to cut both heroin and fentanyl, the likelihood of overdose in the using population is vastly more significant (Recovery First, 2017). The one surprising fact about this incredibly dangerous drug is the relatively low potential for addiction on its own. It is thought that unless a user already has a tolerance to heroin or fentanyl, carfentanil is likely to kill on first use, especially in unregulated quantities like those found on the street (Recovery First, 2017). Aside from the sheer potency of the drug, another cause for concern is the potential threat to healthcare workers, first responders, and bystanders. Since carfentanil and its usual counterparts fentanyl and heroin are so powerful, there is a real possibility that these parties may inadvertently come into contact with dangerous amounts of these substances while attempting to resuscitate a patient or at a scene. Both fentanyl and carfentanil look nearly identical to heroin in its powder form, making it increasingly difficult to identify what substance the first responder is dealing with. The concern of accidental exposure is so great that the Drug Enforcement Administration (DEA) issued a police and public warning outlining the precautions that first responders should

take when dealing with a substance of unknown makeup (Drug Enforcement Administration, 2016). The DEA's recommendations include refraining from disturbing the substance to avoid inadvertent exposure symptoms indicative of exposure, and actions to take should symptoms develop.

The Consquences of the Opioid Epidemic

Deaths Due to Overdoses

As the human body builds develops opioid tolerance, drug addiction can result as users require higher doses to gain the same perception of experiencing a 'high'. What makes opioid drugs so attractive to their users? What makes them worth the risk of dying? For people that are in pain or already addicted, an important aspect is price. On average, prescription opioids run on average about $65 per dose whereas heroin typically averages around $9 per dose. On the street, a patron can get approximately seven doses ('hits') of heroin for the price of one legitimately manufactured pill/dose (Gupta, 2016). Nationwide from 2001 to 2015, the number of annual deaths due to heroin overdose increased nearly 500%, from approximately 2,000 to approximately 10,000 (see Figure 2). This increase is also reflected by the national numbers of deaths for 2016, which increased a staggering 23% to 12, 998. As another indication of the rampant issue of overdose deaths from opiates, overdose deaths overtook gun homicides in 2016 with a total of 52,404 deaths compared to 36,252 (The Associated Press, 2016).

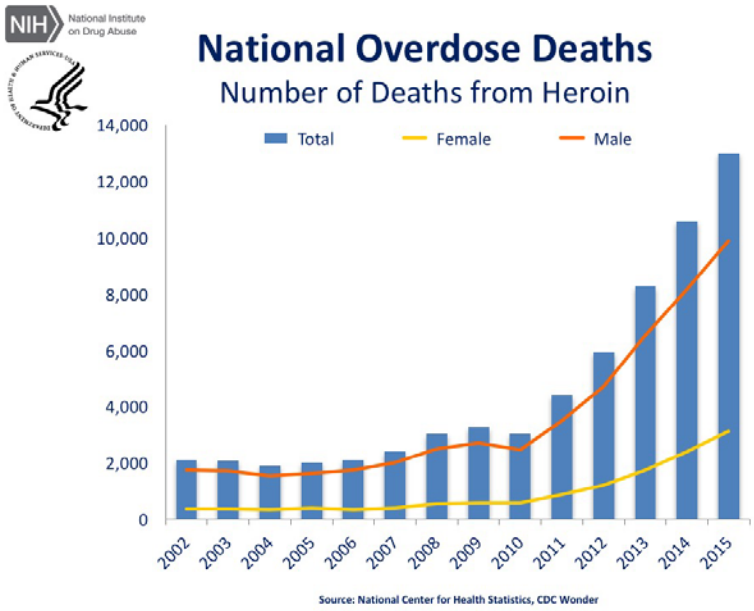

Figure 2. This graph produced by the National Drug Institute on Drug Abuse illustrates the national trend of increasing overdose deaths related to heroin use (National Institute on Drug Abuse, 2017, 2016, fourth image).

Where Do Heroin and Synthetic Opioids Come From?

When talking about heroin/fentanyl/carfentanil and how it enters the United States, historically most of the focus of the conversations tends to focus on their entry from Mexico, South America or Southwest/Southeast Asia (Woody, 2016). Although these are still viable sources of drug entry, two other sources have recently risen to prominence: 1) Mexican drug cartels for heroin, and 2) China for fentanyl/carfentanil, as explained below.

The Mexico Connection

For the Mexican drug cartels, the past focus of smuggling and making money was primarily on the distribution and sale of cocaine and marijuana (Global Post, Public Radio International, 2016). However, with the American trend for legalization of marijuana for both recreation and medicinal uses, the profit margin associated with marijuana dwindled, requiring them to look for other exports; they selected heroin and synthetic opiates. It is estimated that the

amount of pure heroin produced by Mexican cartels rose approximately 67% from 2014 to 2015 and 170% over the numbers estimated for 2013 (Figure 3).

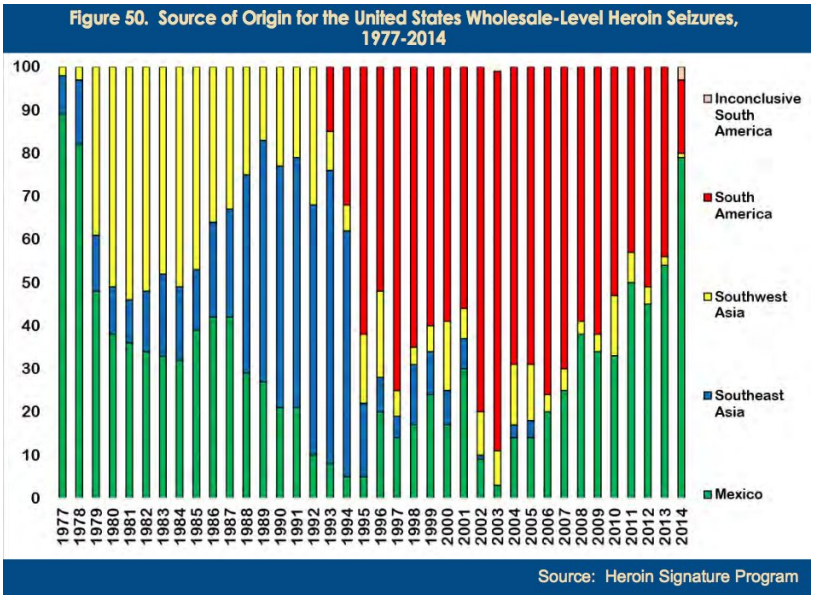

Figure 3. This graph used by Christopher Woody of *The Business Insider* shows the respective origin of the heroin seized in the United States from 1977 to 2014. Its purpose is to illustrate the increasing amount of Mexican made heroin that is being introduced and seized in the United States (Woody, 2016, third image).

The close proximity of Mexico to the United States and the relative ease with which opioids can be smuggled gives Mexico an important role in fueling the current opiate epidemic (Global Post, Public Radio International, 2016). A DEA-released report states that Mexico (primarily the state of Guerrero) supplied roughly 50% of the heroin found in the United States in 2012, with the other 50% coming primarily from Columbia (Dean, 2017). Newer estimates put the Mexican market share of heroin at roughly 80% as of 2014 (Woody, 2016). The Mexican cartels are able to accomplish their market dominance by offering a heroin product with superior quality for lower cost due to lower transportation costs because of the high density of manufacturing locations close to the United States' border. A cheaper, more potent product means that you can command market share, as the cartels have apparently done in a majority of

the United States. The Mexican cartels primarily supply and control the western U.S. heroin market due to the massive influx of heroin through The San Diego Border Corridor, the origin of which is Tijuana, Mexico. After analyzing seized samples via border check points along the southwest U.S., the DEA determined that 96.9% of the samples seized were of Mexican origin (see Figure 3).

East of the Mississippi, South American heroin still predominates, but given the rapid increase in production and U.S. expansion of Mexican heroin, Woody (2016) suggests it is a matter of time before heroin of Mexican origin becomes more commonplace in this area of the country. He states that having market share of the heroin that enters the U.S. is important to Mexican cartels because that has become one of their main sources of revenue. As Figure 4 shows, capturing the large northeast market would be a significant source of income for the Mexican cartels.

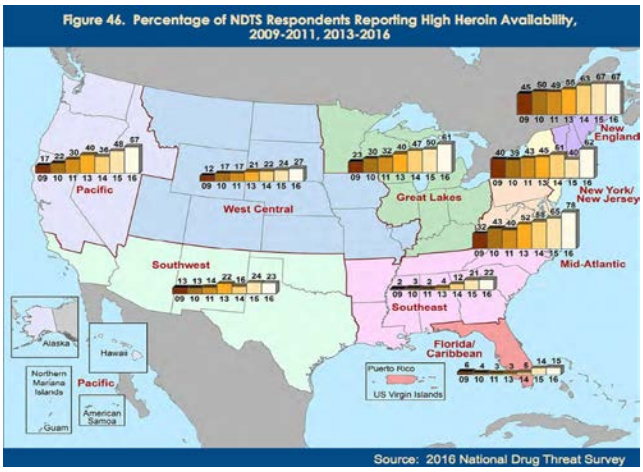

Figure 4. This graph used by Christopher Woody of the *Business Insider* shows the percentage of National Drug Threat Survey respondents (law enforcement agencies) that indicated a high level of heroin activity in their area (Woody, 2016, second image).

China

In order to maximize product strength, some Mexican cartels are combining heroin with fentanyl (or chemicals to make fentanyl) obtained either directly from China, or from China via Canada (Figure 5).

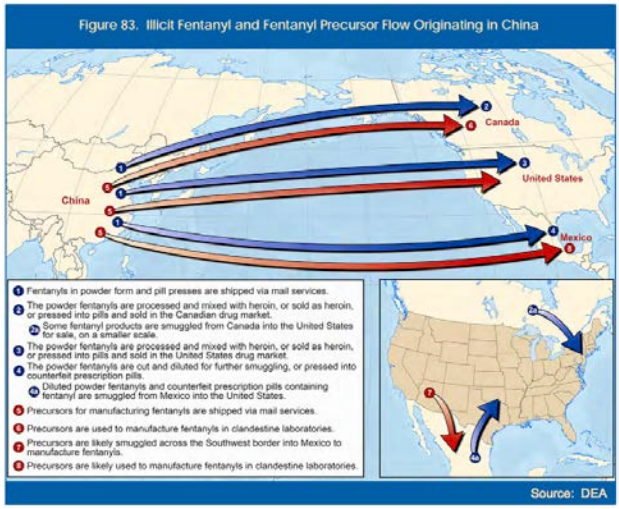

Figure 5. This photo from *Insider Louisville* shows the various ways that fentanyl manufactured and shipped from China makes its way into the United States (Ladwig, 2017, second image).

The particular cartel implicated by the DEA is the infamous Sinaloa Cartel that has become a known distributor of fentanyl, especially in the midwestern and northeastern United States (Bowen, 2017). A cartel can sell a kilogram of heroin for approximately $75,000 U.S. dollars, while a kilogram of fentanyl made in a Chinese laboratory costs about $4,000 U.S. dollars in comparison. This apparently leads to a lucrative profit margin, and leads to heroin either being cut with fentanyl to prolong the supply of heroin, or to fentanyl being labeled and sold as heroin. The other caveat is that not only are Mexican cartels using fentanyl to cut heroin, they are also using pill presses to form fentanyl into tablets that look very similar to either Percocet® or oxycodone to be sold at a premium street price (Ladwig, 2017; Armstrong, 2017). This deliberate mislabeling of fentanyl as heroin and commonly abused prescription pain

medications has led to unexpected overdoses and deaths due to fentanyl's potency (Armstrong, 2017). Users are getting what they think is their normal dose of heroin, when in actuality they are getting a potentially lethal dose of fentanyl.

Armstrong (2017) identifies China as a secondary culprit in the U.S. opioid crisis because it is disturbingly easy to obtain both fentanyl and carfentanil (and their chemical components) from China. In addition, China is also playing a role in the distribution of the machinery (pill presses) necessary to make fentanyl look like other commonly abuse prescription pain tablets.

These drugs are often transported and delivered by the United States Postal Service (USPS), and often delivery was guaranteed to major Western capital cities (Hills, 2017). One researcher even found Chinese companies that would deliver both carfentanil and fentanyl directly to a customer's door, courtesy of the USPS. USPS, being a federal agency that handles international packages, should have a mandatory screening process that would prevent transport and delivery of illegal drugs: however, this is not the case (services coalition: http://servicescoalition.org/images/Copenhagen_Economics_-_Packages_import_study_Final_Sept08.pdf). In fact, the USPS does not require advanced electronic screening techniques when accepting international packages (Hills, 2017). Ironically, a majority of the private postal carriers like United Postal Service (UPS) and FedEx do have mandatory electronic screening (services coalition). This serves a major deterrent for shipping illicit substances via these private services, to the extent that there is even a reported warning on the 'darknet' [1]to not use private shipping companies if one wishes to ship drugs or other illegal items into the U.S. (Hills, 2017). Advanced electronic screening usually consists of documenting who the package is coming from, who it is going to, the contents of the package, the weight of the contents and number of items in the package (Hills, 2017). If such a system was in place for

[1] See https://en.m.wikipedia.org/wiki/Darknet for information about the Darknet.

the USPS, there is a greater likelihood of trend identification and potentially stopping fentanyl and other illicit substances from entering the U.S. in this way. The onus does not solely rest on the USPS, as China's mail system does not have an electronic screening requirement either, making it open for the distribution of illicit substances. Hills (2017) reports that it appears that China has been trying to turn over a new leaf in terms of its role as a makeshift distribution hub. In recent months, with U.S. DEA cooperation, they have banned an estimated 116 of the most dangerous synthetic drugs affecting North America. China has gone as far as to make carfentanil a controlled substance, allowing the Chinese government to seize the product and laboratory equipment (Hills, 2017). Although this is a good first step, the reality is that it will take some time to label and enforce carfentanil as a controlled substance. Further, fentanyl can still be easily made by other parties in clandestine labs in other countries outside of the United States for distribution, to replace the Chinese products (Ladwig, 2017).

The Epidemic Evolution

There is no one factor that to blame for the heroin and opioid epidemic. However, there is a very precise sequence of events that accelerated the rate of opioid prescription and usage. Starting in the 1990s there was an outcry in the medical community that not only was the pain level of patients under-assessed, it was also undertreated. This set the stage for what many consider to be the initial step leading to the current epidemic, pain being introduced as *the fifth vital sign*. This verbiage was first introduced into literature in 1996 by the National Pharmaceutical Council (NPC) (National Pharmaceutical Council, 2001). The NPC's goal was to elevate the pain assessment of patients to the same level of importance as traditional vital signs (respiratory rate, pulse, blood pressure and temperature) (National Pharmaceutical Council, 2001). From this document came the advent of unidirectional pain scales and the notion that the

most reliable way to collect a valid indicator of a patient's pain was to ask them directly. The document advocated for the appropriate use of pain scales and treatment for special populations (e.g., cancer and post-surgical patients) and the prudent use of pharmacologic and/or non-pharmacologic pain-relieving measures. After the publication of the NPC's recommendation, coinage of pain as the fifth vital sign, and emphasis placed on control of each patient's perceived pain, major medical societies (and the American Medical Association [AMA] in particular) adopted this notion and promoted the recommendation to its members. Support of this concept by the AMA was paramount due to the organization's status in public health policy-making: Its over 200,000 members would be impacted by this support (Anson, 2016).

In 2001 *The Joint Commission on Accreditation of Healthcare Organization* (JCAHO), now known as *The Joint Commission*, one of the primary accreditation and certification bodies for healthcare organizations and programs, released revised pain standards aligned with the fifth vital sign concept. Although The Joint Commission did not explicitly endorse the use of pain as the fifth vital sign, references were made to other major medical organizations that did use this new indicator. These new standards required that a patient's pain was to be assessed on every visit using the best tools available and documented. Physicians now had to ask how much pain a patient was in during every visit and document in the chart how they planned to alleviate this pain. Considering that the new standard was handed down by the accrediting body of almost 21,000 medical facilities (The Joint Commission, n.d.), practitioners not in compliance with these regulations faced reprimands. If, for instance, a physician had a patient that was seen multiple times for the same pain without improvement , that medical facility would be scrutinized, because it would appear that patient's pain complaints were not properly identified and/or addressed. Patients with reoccurring pain were seen as a liability by medical facilities.

Because reaccreditation was partly based on whether patients were adequately serviced, physicians began to prescribe pain medication rather than or in addition to non-pharmacologic pain relief methods to avoid being identified as not properly treating patients for pain. As illustrated by Figure 6, opioid drug prescriptions steadily increased since 1991. The more important aspects of this figure are the noticeable bumps in the prescription of both hydrocodone and oxycodone during the 1996 to1998 time periods and the 2001 to 2003 time periods. These two time periods correspond to the release made by the NPC and the updated pain standards by The Joint Commission, respectively. Although these two policy statements did not start the opioid drug use epidemic, they are viewed as catalyzing events (Volkow & McLellan, 2016).

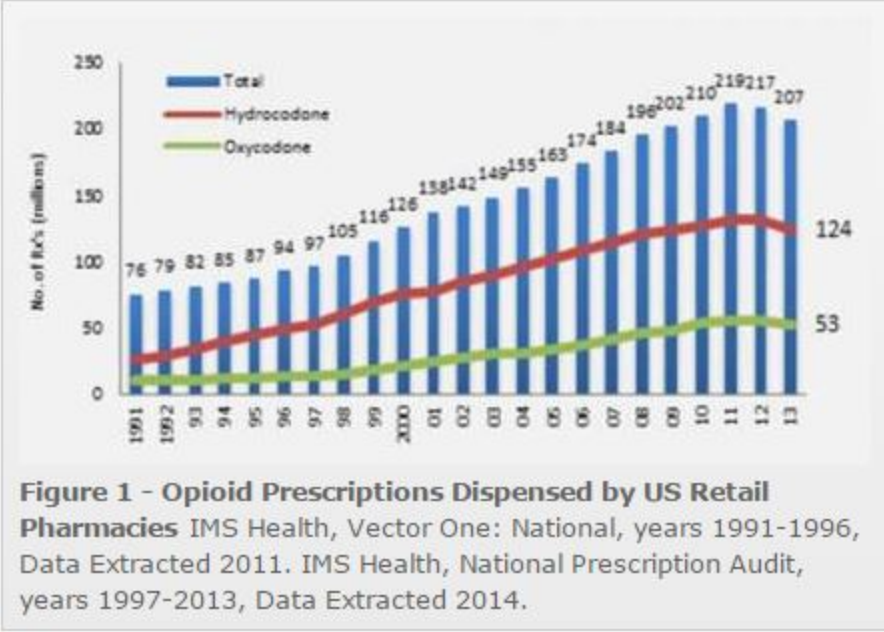

Figure 1 - Opioid Prescriptions Dispensed by US Retail Pharmacies IMS Health, Vector One: National, years 1991-1996, Data Extracted 2011. IMS Health, National Prescription Audit, years 1997-2013, Data Extracted 2014.

Figure 6. This graph from the National Institute on Drug Abuse illustrates the increasing amount of prescription opiates that dispensed with notable increases in 1996-1997 when pain was introduced as a fifth vital sign, and in 2001 when The Joint Commission released its revised pain standards (National Institute on Drug Abuse, 2014, first image).

The Introduction of "Pill Mills"

Using the guidance given by both a major medical association and The Joint Commission, physicians began assessing every patient for perceived pain. The issue with such

frequent evaluation is that in order to meet the proposed guidelines of ‘adequately’ treating a patient’s pain, physicians began using opioids to treat both acute and chronic pain. The rationale was that if the patient was completely pain-free and verbalized that during the encounter, physicians would not face disciplinary actions during re-accreditation. Within previous treatment guidelines, even with these recommendations, the likelihood of addiction was expected to be low (Goleman, 1987). However, in special populations where rather large amounts of pain relief were required (cancer, post-surgery, and chronic pain patients), the risk of addiction was apparently higher. Often these patients would receive a specified amount of medication and receive refills or turn to other means of pain relief (e.g., street drugs). Enter the "Pill Mill," which the Florida Office of the Attorney General (2015, first paragraph) defines as “a doctor’s office, clinic, or health care facility that routinely conspires in the prescribing and dispensing of controlled substances outside the scope of the prevailing standards of medical practice in the community or violates the laws of the state”. Unscrupulous physicians noticed this population of patients that needed/required strong pain relief and essentially took advantage of this situation. These opportunistic physicians set up independent pain management centers, often accepted cash only and allowed patients to receive their drug of choice (Malbran, 2007). These and similar practices throughout the country set the foundation for the current opioid epidemic by unethically prescribing medications that not only had a high likelihood of addiction when given over long periods of time, but also falsely giving the impression that these medications would always be readily available. With a seemingly unlimited supply of prescription opiate pain relievers, some patients turned to selling their medications on the street for profit and fostering the illegal market for this class of medication (Rigg, March, & Inciardi, 2010). The increase in the illegal

distribution of prescription opioids organically led to an increase in the number of overdoses and deaths (Figure 7).

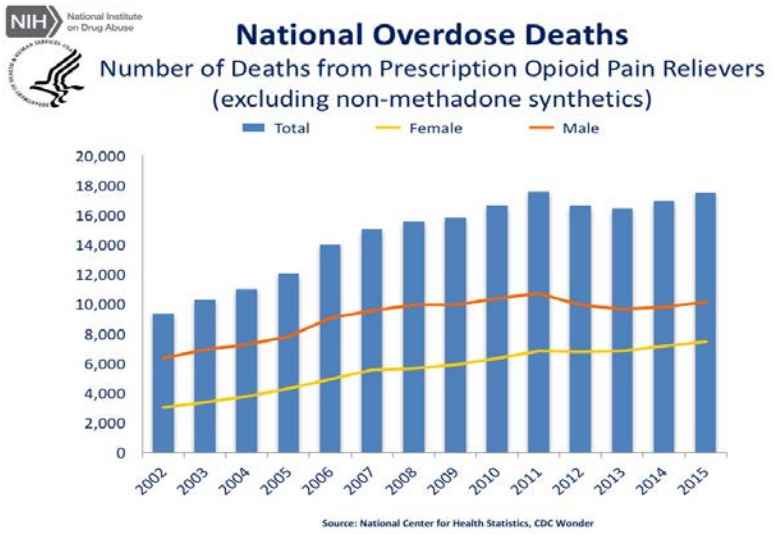

Figure 7. This graph from the National Institute on Drug Abuse depicts the increasing rate of overdose deaths related to prescription opiates. So-called "pill mills" contributed to this trend due to their unchecked distribution of these medications (National Institute on Drug Abuse, 2017, third image down).

In response to the rapidly increasing rate of overdoses and deaths related to prescription opioid use, the medical community was forced to reevaluate its stance and policies regarding pain control in patients. In their reevaluation of their pain treatment recommendations, The Joint Commission removed the requirement to assess a patient's pain on every visit as of 2009 (Baker, 2016). However, The Joint Commission did maintain that patients with behavioral health issues must have their pain accurately assessed on each interaction (Baker, 2016). Additionally, major medical organizations that once touted the use of pain as the fifth vital sign now removed it completely from healthcare recommendations. More specifically, the AMA maintained that the growing opioid issue was stemming largely from physician over-prescribing opiates as pain relievers (Anson, 2016). The introduction of new legislation directed at closely monitoring the prescribing of opiate pain relievers by physicians resulted from abuse of these drugs. Pill mills

were forced to close and the physicians involved were punished. Of particular importance was the introduction and widespread use of prescription drug monitoring programs in numerous states and the development of so called ‘pill mill' laws in states that were being hit the hardest by the epidemic in 2010 and 2011 (e.g., Florida: see Florida Office of the Attorney General, 2015). The new laws required stand-alone pain clinics to be registered with their respective state and restricted the distribution of prescription opioid pain relievers on site at the clinic. In conjunction with these measures, Purdue Pharma, the primary manufacturer of both oxycontin and hydromorphone was forced to change the formulation of these medications after being found guilty of misrepresenting their potentially addictive nature (Ingraham, 2017). The new formulation made it harder for the pills to be abused by being crushed for snorting/injecting or chewed (Ingraham, 2017). Those pill mill patients that were selling or illicitly using opioid medications now had a limited supply or none at all. Pill mill patients were forced to find another means of either pain control or illicit opioid use, opening the door to heroin use for some (Ingraham, 2017).

The Current Problem in Ohio

The opioid drug overdose and death statistics have been steadily growing since the 1990s. Ohio is among several states that have seen a staggering increase in the number of overdoses, and it has reached epidemic levels: an epidemic is defined as affecting or tending to affect a disproportionately large number of individuals within a population, community, or region at the same time (Epidemic, n.d.). This definition is an accurate portrayal of just how significant of an impact heroin has made in Ohio. The Ohio Department of Health (ODH) estimates that the number of overdoses and deaths due to opioid overdose will continue this upward trend. The total number of opioid deaths in Ohio for all of 2016 were 4,149, more than a 39% increase over

the number reported for 2015 (The Associated Press, 2016). Looking at individual counties, Cuyahoga County, where Cleveland is the largest city, led the way with 666 opioid deaths in 2016 (The Associated Press, 2016). Given rates for the first half of 2017, Cuyahoga County appeared on pace to top 2016's 775 overdose deaths due to heroin and fentanyl use (MacDonald, 2017). Montgomery county was not far behind, with nearly 360 overdose deaths as of 1 June 2017, putting it on pace to potentially exceed 800 deaths by the end of the year, more than the 349 reported for 2016 (Llorente, 2017). Hamilton County, home to Cincinnati, appeared on pace to exceed its 2016 number of total deaths (403 [Parker, 2017]) as well, with almost 300 deaths in the first half of 2017.

In 2016 it was estimated that 23 people in Ohio died daily from opiate overdoses (Kitchen, 2016). The number of deaths associated with opioid abuse in Ohio is climbing at such a rapid rate that several city morgues are turning to local funeral homes and mobile chilling units to store the bodies until autopsy (CBS News & The Associated Press, 2017). Given the steep upward trend and the given definition of an epidemic, indications are that the State of Ohio has reached epidemic numbers of opioid related deaths and overdoses with little sign of slowing down.

What is Being Done to Combat the Opioid Epidemic?

With the various iterations of heroin and synthetic opiates that are circulating the streets, first responders have few resources to immediately treat overdose patients. Perhaps the most well-known and important pre-hospital treatment is *naloxone*. Naloxone is commonly known by its trade name, Narcan® and effectively reverses the central nervous system depression that is produced when a person overdoses on opiate based medications. This drug can be administered either by a nasal spray (most common) or via an intramuscular injection. Its effectiveness stems

from having a higher affinity for the mu opiate receptors in the brain (Figure 8) than illicit drugs such as heroin and prescription medications such as oxycodone or Percocet (Kounang, 2016).

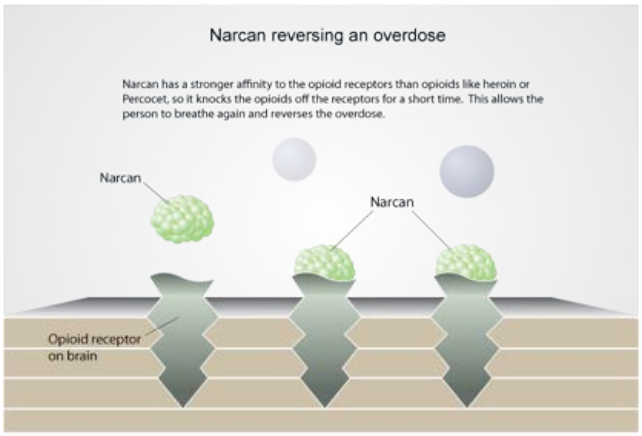

Figure 8. This image from the Harm Reduction Coalition and shows how Naloxone works to reverse an overdose by displacing the opiate from the mu receptor in the brain (Harm Reduction Coalition., n.d., middle of page).

This greater affinity and replacement on the mu receptor reverses the opioid effects and gives the overdosed patient a chance at being further resuscitated in a medical facility. With this being said, naloxone only works when there is an opiate in the patients system: it is useless for overdoses of a different drug class. The downside is that its reversal effects last only about 20 to 90 minutes, depending on the drug in the patient's system (Kounang, 2016), allowing for potential overdose following successful revival. Traditionally, naloxone was used primarily in emergency departments and by first responders given that both settings were the first time overdose patients were seen by a medical professional. However, there has been a shift in the conversation about who should have access to naloxone in an effort to decrease the number of overdose deaths. The current conversation and law trends show that many states are making it easier for bystanders, potential overdose patients and their families to obtain naloxone through various distribution programs (e.g., Project DAWN [Deaths Avoided with Naloxone] http://www.odh.ohio.gov/health/vipp/drug/ProjectDAWN.aspx). It is estimated that there are

approximately 188 programs across the U.S. that are directly involved in providing naloxone to intravenous drug users (Coe & Walsh, 2015). Given the rapid increase in the number of opioid overdose deaths over the past several years, the number is likely to increase. In addition to the advent of naloxone distribution programs, many states are making it easier for non-physician medical professionals to prescribe and dispense the medication which in turn increases access. In fact, laws in 20 states now allow major retail pharmacies to make naloxone available to consumers without a prescription (Kounang, 2016). Perhaps the biggest recent change in the distribution and use of naloxone has been the reduction or removal of legal liability for civilian bystanders in several states if there is an adverse outcome after administering naloxone to a person suspected of having an opioid overdose (Coe & Walsh, 2015). Existing Good Samaritan laws have been broadened accommodate naloxone use. Also, in an effort to promote calling 911 when an overdose is suspected, over 22 states have amended their Good Samaritan laws to allow citizens to report an overdose to 911 without fear of arrest (Coe & Walsh, 2015). This is important because fellow users are most likely to be present when someone overdoses. In addition to these measures, numerous communities hit hardest by the overdose epidemic have developed overdose education and naloxone distribution (OEND) programs. The programs can go by various names but the emphasis and focus of the programs remain the same. The goal of the program is to educate the community on the dangers of using intravenous drugs, how to recognize an overdose, and how to properly administer naloxone (Coe & Walsh, 2015). After evaluation of one such program, it was found that even communities in which a relative few members of the community (less than 100 per 100,000) attended such programs there was a significant decrease in the number of overdose deaths compared to communities without a program (Coe & Walsh, 2015).

Even with the expansion of naloxone use, the implementation of community programs and less restrictive laws, the opioid problem still remains. Given the much higher affinity that fentanyl and carfentanil have for the brain's opioid receptors, responders find that it is taking an increasing number of naloxone doses to resuscitate overdose patients (M. Gebhardt, personal communication, Spring 2017). The usual dose that is administered by emergency medical services in the field for a heroin overdose is 2mg/ml via nasal spray (M. Gebhardt, personal communication, Spring 2017). With the preponderance of synthetic opiates and subsequent cutting with heroin, the Centers for Disease Control and Prevention (2015) now advocates that agencies plan for the use of multiple doses of naloxone per patient because a responder is unlikely to know which opiate the patient overdosed on. This increase in the number of doses required to revive patients brings in the question of additional intervention cost. On average, one intranasal naloxone dose costs $63 U.S. dollars, with the newer naloxone auto injectors, similar to the common EpiPen®, costing upwards of $2,000 U.S. dollars per dose (Jacobs, 2016). For small community programs and emergency medical services, this cost could quickly eat through their allotted budget. (Note: There is no additional medical benefit to using the auto injector variant of naloxone versus the intranasal spray). With this in mind, the U.S. government allocated approximately $1.1 billion U.S. dollars of the 2017 budget to aid in fighting the overdose epidemic (Kounang, 2016). Of that $1.1 billion U.S. dollars, approximately 500 million was specifically designated to help broaden overdose prevention related to prescription drugs, and to further increase the access to naloxone (Kounang, 2016).

Conclusion

The ongoing opioid epidemic plaguing the United States is an issue that has had numerous contributors that have propelled the issue to its current level. As shown in this

manuscript, the introduction of pain as the fifth vital sign, the reformulation of commonly abused prescription drugs, and the establishment of pill mills were all instrumental in initiating the current opioid crisis. The relative ease with which heroin and its synthetic counterparts are able to enter the United States from countries such as China and Mexico, and the proliferation of foreign and domestic clandestine labs has helped to push the opioid use and abuse to epidemic levels. The primary intervention at the disposal of healthcare workers and respective communities is the use of OEND programs and making naloxone readily available in those communities hit hardest. However, with the current trend of more powerful synthetic opiates being introduced to the street market in conjunction with combining several opiates into one product, it is taking more naloxone to reverse suspected overdoses. From this perspective, the future appears rather bleak with no clear answer to how slow, this destructive wave of morbidity and mortality deaths due to opiate use and abuse[2]. The versatility and multidisciplinary skills of the public health workforce will play an integral role in helping to address this multifaceted problem.

[2]Editor's note: After final manuscript acceptance, Committee Reader Dr. Sara Paton wished to note that the Pax Good Behavior Game® (http://goodbehaviorgame.org/) is an evidence-based prevention technique that is a promising community strategy for intervention among school-aged children. It is included in the Substance Abuse and Mental Health Services Administration's (SAMHSA's) National Registry of Evidence-based Programs and Practices (http://legacy.nreppadmin.net/ViewIntervention.aspx?id=351).

References

Allouche, S., Noble, F. & Marie, N. (2014). Opioid receptor desensitization: Mechanisms and its link to tolerance. *Frontiers in Pharmacology, 5*(280), 1-20. Retrieved from http://journal.frontiersin.org/article/10.3389/fphar.2014.00280/full

American Addiction Centers. (n.d.). What is heroin cut with? Mixing agents, substitutes & adulterants. Retrieved from http://americanaddictioncenters.org/heroin-treatment/cut-with/

Anson, P. (Ed.). (2016, June 16). AMA Drops Pain as Vital Sign. Retrieved from https://www.painnewsnetwork.org/stories/2016/6/16/ama-drops-pain-as-vital-sign

Armstrong, D. (2017, March 20). Chinese suppliers flood US and Canada with deadly fentanyl. Retrieved from https://www.statnews.com/2016/04/05/fentanyl-traced-to-china/

The Associated Press. (2016, December 09). Drug overdoses now kill more Americans than guns. Retrieved from http://www.cbsnews.com/news/drug-overdose-deaths-heroin-opioid-prescription-painkillers-more-than-guns/

Baker, D. (2016, April 18). Joint Commission statement on pain management. Retrieved from https://www.jointcommission.org/joint_commission_statement_on_pain_management/

Bond, A. (2016, September 29). Why fentanyl is deadlier than heroin, in a single photo. Retrieved from https://www.statnews.com/2016/09/29/fentanyl-heroin-photo-fatal-doses/

Bowen, J. (2017, April 13). Massive drug bust in Dayton connected to Mexican drug cartel Sinaloa. Retrieved from http://wdtn.com/2017/04/13/montgomery-county-sheriff-and-ohio-ag-announce-large-fentanyl-seizure/

CBS News & The Associated Press. (2017, March 14). Mobile cooling unit used after Ohio county morgue runs out of space. Retrieved from http://www.cbsnews.com/news/ohio-coroner-mobile-cooling-unit-morgue-overdoses/

Centers for Disease Control and Prevention. (2015, October 26). Increases in fentanyl drug confiscations and fentanyl-related overdose fatalities. Retrieved from https://emergency.cdc.gov/han/han00384.asp

Coe, M. A., & Walsh, S. L. (2015). Distribution of naloxone for overdose prevention to chronic pain patients. *Preventive Medicine, 80,* 41-43. doi:10.1016/j.ypmed.2015.05.016

Dean, M. (2017, March 2). FBI's Comey: Mexican drug cartels fueling US heroin epidemic. Retrieved from http://www.foxnews.com/us/2017/03/02/fbis-comey-mexican-drug-cartels-fueling-us-heroin-epidemic.html

Drug Enforcement Administration. (2016, September 22). DEA issues carfentanil warning to police and public. Retrieved from https://www.dea.gov/divisions/hq/2016/hq092216.shtml

Epidemic. (n.d.). In Merriam-Webster dictionary online. Retrieved from https://www.merriam-webster.com/dictionary/epidemic

Florida Office of the Attorney General. (2015). Pill mills: Pill mill initiative. Retrieved from http://myfloridalegal.com/pages.nsf/Main/AA7AAF5CAA22638D8525791B006A30C8

Global Post, Public Radio International. (2016, November 17). Why heroin is Mexican drug cartels' new product of choice. Retrieved from https://www.usatoday.com/story/news/world/2016/11/17/heroin-mexican-drug-cartel/94032394/

Goleman, D. (1987, December 30). Health: Patient care; Physicians said to persist in undertreating pain and ignoring the evidence. Retrieved from http://www.nytimes.com/1987/12/31/us/health-patient-care-physicians-said-persist-undertreating-pain-ignoring-evidence.html?pagewanted=all

Gupta, S. (2016, June 02). Unintended consequences: Why painkiller addicts turn to heroin. Retrieved from http://www.cnn.com/2014/08/29/health/gupta-unintended-consequences/

Harm Reduction Coalition. (n.d.). Understanding naloxone. Retrieved from http://harmreduction.org/issues/overdose-prevention/overview/overdose-basics/understanding-naloxone/

Higashikawa, Y., & Suzuki, S. (2008). Studies on 1-(2-phenethyl)-4-(N-propionylanilino)piperidine (fentanyl) and its related compounds. VI. Structure-analgesic activity relationship for fentanyl, methyl-substituted fentanyls and other analogues. *Forensic Toxicology, 26*(1), 1-5. doi:10.1007/s11419-007-0039-1

Hills, C. (2017, January 20). Lethal opioids from China getting to U.S. courtesy of postal service. Retrieved from https://www.usatoday.com/story/news/world/2017/01/20/lethal-opioids-china-united-states-postal-service/96831328/

Ingraham, C. (2017, January 10). How an ‘abuse-deterrent’ drug created the heroin epidemic. Retrieved from https://www.washingtonpost.com/news/wonk/wp/2017/01/10/how-an-abuse-deterrent-drug-created-the-heroin-epidemic/?utm_term=.8cde49c11d89

Jacobs, H. (2016, August 01). The price of the 'antidote' to the overdose crisis is skyrocketing. Retrieved from http://www.businessinsider.com/price-of-naloxone-narcan-skyrocketing-2016-7

The Joint Commission. (n.d.). About the Joint Commission. Retrieved from https://www.jointcommission.org/about_us/about_the_joint_commission_main.aspx

Kitchen, K. (2016, November 21). Ohio suffers 23 opiate overdoses every week. Retrieved from http://usamdt.com/northeast-ohio/blog/ohio-suffers-23-opiate-overdoses-every-week/

Kounang, N. (2016, April 28). What is naloxone? Retrieved from http://www.cnn.com/2016/04/28/health/what-is-naloxone-narcan-opioid-overdose/

Ladwig, B. (2017, April 27). DEA agent: Fentanyl's rise in opioid crisis is a matter of pure profit. Retrieved from https://insiderlouisville.com/metro/dea-agent-fentanyls-rise-in-opioid-crisis-a-matter-of-pure-profit/

Llorente, E. (2017, June 5). Ohio drug overdose deaths in one county already top last year's total. Retrieved from http://www.foxnews.com/us/2017/06/05/ohio-drug-overdose-deaths-in-one-county-already-top-last-years-total.html

MacDonald, E. (2017, May 19). Cuyahoga County heroin, fentanyl overdose deaths on pace to far exceed last year's total. Retrieved from http://www.cleveland.com/metro/index.ssf/2017/05/cuyahoga_county_heroin_fentany_1.html

Malbran, P. (2007, May 31). What's a pill mill? Retrieved from http://www.cbsnews.com/news/whats-a-pill-mill/

National Center for Biotechnology Information. (n.d.). Carfentanil. Retrieved from https://pubchem.ncbi.nlm.nih.gov/compound/carfentanil

National Institute on Drug Abuse. (2014a, November 13). What effects does heroin have on the body? Retrieved from https://www.drugabuse.gov/publications/research-reports/heroin/how-heroin-used

National Institute on Drug Abuse. (2014b, April 29). Prescription opioid and heroin abuse. Retrieved from https://www.drugabuse.gov/about-nida/legislative-activities/testimony-to-congress/2016/prescription-opioid-heroin-abuse

National Institute on Drug Abuse. (2016, June 3). Fentanyl. Retrieved from https://www.drugabuse.gov/publications/drugfacts/fentanyl#references

National Institute on Drug Abuse. (2017, January 6). Overdose death rates. Retrieved from https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates

National Pharmaceutical Council. (2001). *Pain: Current understanding of assessment, management, and treatments*. Reston, VA: National Pharmaceutical Council, Inc. Retrieved from http://www.npcnow.org/system/files/research/download/Pain-Current-Understanding-of-Assessment-Management-and-Treatments.pdf

The National Safety Council. (2014). Opioid painkillers: How they work and how they can be risky. Retrieved from http://www.nsc.org/RxDrugOverdoseDocuments/opioid-painkillers-how-they-work-and-why-they-are-risky.pdf

Parker, T. (2017, June 19). Hamilton County heroin overdoses: County on pace to have more overdose deaths this year than 2016. Retrieved from http://www.wcpo.com/news/local-news/hamilton-county/hamilton-county-heroin-overdoses-county-on-pace-to-have-more-overdose-deaths-this-year-than-2016

Pflaum, N. (2016, March 14). Most heroin in U.S. now comes across Mexican border, Rob Portman says. *PolitiFact Ohio*. Retrieved from http://www.politifact.com/ohio/statements/2016/mar/14/rob-portman/most-heroin-us-comes-over-mexican-border/

Recovery First. (2017). What is carfentanil? Retrieved from http://www.recoveryfirst.org/what-is-carfentanil/

Rigg, K. K., March, S. J., & Inciardi, J. A. (2010). Prescription drug abuse & diversion: Role of the pain clinic. *Journal of Drug Issues, 40*(3), 681-702. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3030470/

Stewart, C. (2014, December 20). Overdose deaths tied to potent new drug. Retrieved from http://www.mydaytondailynews.com/news/crime--law/overdose-deaths-tied-potent-new-drug/mykn7eWgzHJEVRapH1vlKM/

Volkow, N. D., & McLellan, A. T. (2016). Opioid abuse in chronic pain — Misconceptions and mitigation strategies. *New England Journal of Medicine, 374*(13), 1253-1263. doi:10.1056/nejmra1507771

White, J. M., & Irvine, R. J. (1999). Mechanisms of fatal opioid overdose. *Addiction, 94*, 961-972. doi:10.1046/j.1360-0443.1999.9479612.x

Woody, C. (2016, December 7). Mexican cartels are expanding their control over the US heroin market. Retrieved from http://www.businessinsider.com/mexican-control-us-heroin-market-2016-12

Appendix A: List of Competencies Met in CE

Wright State Program Public Health Competencies Checklist

Assess and utilize quantitative and qualitative data.
Apply analytical reasoning and methods in data analysis to describe the health of a community.
Describe how policies, systems, and environment affect the health of populations.
Communicate public health information to lay and/or professional audiences with linguistic and cultural sensitivity.
Make evidence-informed decisions in public health practice.
Evaluate and interpret evidence, including strengths, limitations, and practical implications.
Demonstrate ethical standards in research, data collection and management, data analysis, and communication.
Explain public health as part of a larger inter-related system of organizations that influence the health of populations at local, national, and global levels.

Concentration Specific Competencies Checklist

Emergency Preparedness:
Communicate and manage information related to an emergency
Use research and/or evaluation science methodologies and instruments to collect, analyze and interpret quantitative and qualitative data